ENGINEERING AT CORNELL 1967 1968

CORNELL UNIVERSITY ANNOUNCEMENTS

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This Announcement is intended to serve as an outline of the opportunities available to students considering the College of Engineering at Cornell. Detailed information concerning the various curricula and courses are described in the *Announcement of the College of Engineering*, which may be obtained by writing to the Announcements Office, Edmund Ezra Day Hall, Cornell University, Ithaca, New York 14850.

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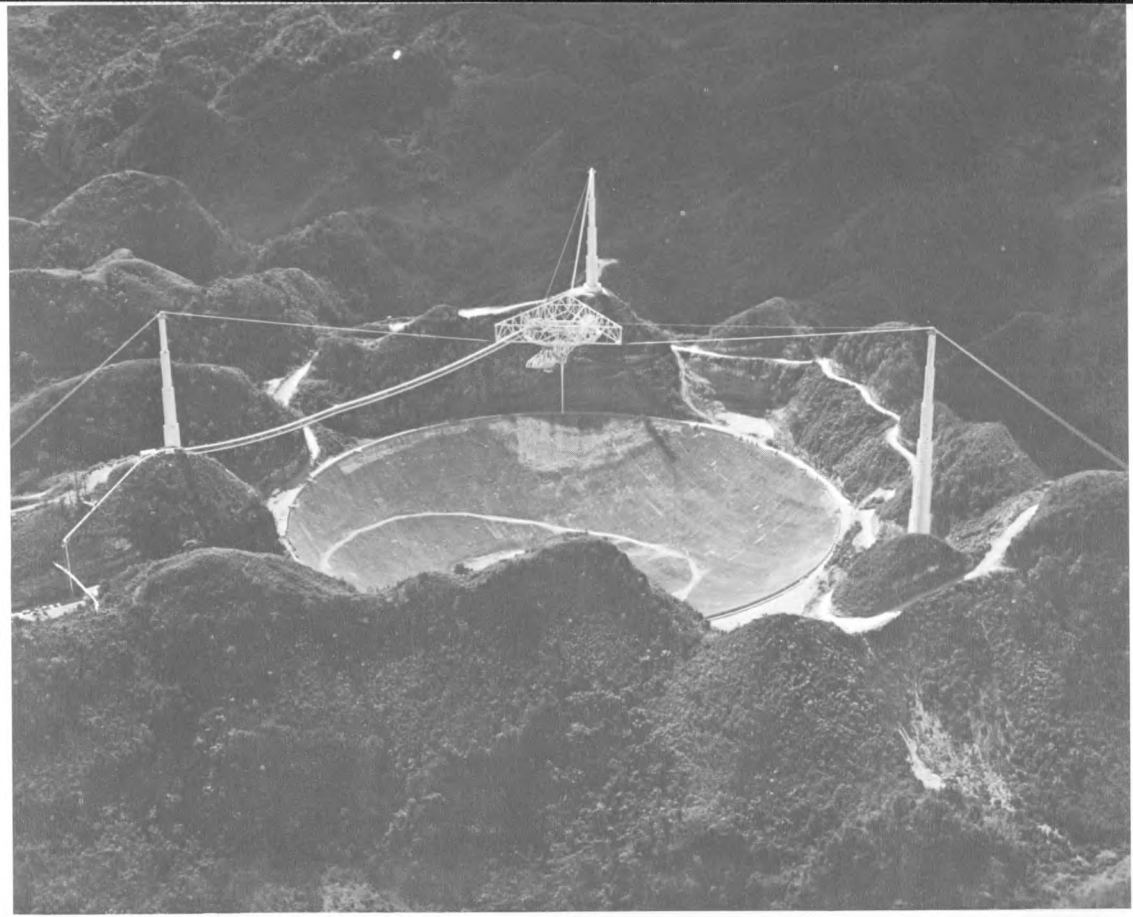
INTRODUCTION

It is a private and a public university, nonsectarian, a member of the Ivy League, a coeducational institution, a confederation of fifteen academic divisions, probably the most educationally diverse university in America, a lively and stimulating mix of undergraduate and graduate students from every state in the country and from ninety other nations, and a residential university with a supremely beautiful campus. It has alumni ranging from engineers to classical scholars to home economists to farmers to architects to scientists to hotel administrators to labor arbiters to doctors to lawyers to veterinarians.

All this mirrors the wishes of Ezra Cornell in founding the University in 1865: "I would found an institution where any person can find instruction in any study." Mr. Cornell was a pioneer in the real sense; he developed the first workable transmission lines for what became the Western Union Telegraph Company, and he supervised the laying of the first line between Baltimore and Washington, D.C. Through his own work experiences, Ezra Cornell became aware that the nation's interests were not being adequately served by its colleges and universities. Until this time, higher education in the traditional European sense and the emerging American concept of the Land Grant College had been developing separately from one another. With Andrew D. White, who was to become the University's first president, Ezra Cornell set about merging the best in both of these ideas to found his "radical" university.

Cornell University has continued to reflect the pioneer spirit of Ezra Cornell and Andrew D. White in the vitality and diversity of its curricula, constantly changing to meet new and anticipated needs; through the public services of its faculty which are carried on all over the world; and in the diversity and vigor of the student body itself. Cornell University continues to be a model, idealistic and practical, to which other colleges and universities can look for insight and leadership in education today.



Aerial view of the Arecibo radar-radio telescope, the world's largest, located in Puerto Rico. The telescope was conceived and designed by faculty members of the College of Engineering and is now operated by the University.

CONTENTS

The McGraw Tower of Uris Library and the John M. Olin Research Library, seen from the Arts Quadrangle.

ENGINEERING AND CORNELL

Instruction in engineering has always played a major role in the University's academic structure. Cornell has long been a pioneer in engineering education, tracing its beginnings to the founding days of the University. The first Cornell engineering degrees were granted in 1871 in the field of civil engineering; they were followed in 1873 by the first degrees in mechanical engineering. In 1885, the first electrical engineers in America were graduated from the University. Later on, Cornell was in the vanguard that led to the emergence of industrial engineering, engineering physics, aerospace engineering, and nuclear engineering.

Graduate study in engineering also had an early start at Cornell, with the granting of the professional degree, Civil Engineer, in 1870. The first Cornell doctorate was granted to a civil engineer in 1872; the first doctorate in electrical engineering was awarded in 1885, in hydraulics, in 1896.

The diversity of engineering activity and the well-developed professional, graduate-level patterns in engineering education have always been Cornell hallmarks. More important, the University has demonstrated the educational excellence derived from the integration of quality technical education with quality general education. Cornell University is today one of the few private American universities that enjoys good reputations in both engineering and liberal arts.

As early as 1946, Cornell felt that education for professional leadership required more than the traditional four years of undergraduate education. It was then that a five-year integrated professional engineering degree program was instituted. While all Cornell engineering graduates today receive a Bachelor of Science degree at the end of four years, more than half continue in one of the many professional programs for another year, receiving their engineering degree, Master of Engineering; most of the others pursue graduate research degrees at Cornell or elsewhere. About 90 percent of Cornell's engineers now enter the profession with at least a Master's degree, compared with a national figure of about 30 percent.

Today there are 1,900 undergraduate men enrolled in the College of Engineering, accounting for 28 percent of all male University undergraduates. An additional 750 engineers are enrolled in a variety of graduate programs—Master of Science, Master of Engineering, and Doctor of Philosophy; they account for about 25 percent of the University's total male graduate enrollment. Cornell stands first among the private universities in the United States in total enrollment of engineering degree candidates.

There are about 180 faculty members in the College of Engineering, and more than 75 percent have doctorates. It is a cosmopolitan faculty; their education was earned at more than ninety different colleges and universities throughout the world. *All* faculty members teach in the undergraduate programs, most teach in the graduate

programs. More than forty faculty members are involved in the introductory freshman engineering courses; another twenty-five serve as freshman or sophomore advisers; and about 125 work with graduate students in one of a number of research projects, about a hundred of which are currently under way. Commitment to engineering education, then, continues to be a substantial part of the University's efforts in education.

Engineering instruction and research are housed in ten modern, spacious buildings with more than fourteen acres of floor space; most of the buildings are gifts of distinguished Cornell engineering alumni. A superior library system offers generous space for quiet study; it contains 3,000,000 volumes distributed among a general undergraduate library, a research library, and eleven professional libraries including one for engineering.

The accelerating expansion of modern science and technology poses a complex and exciting challenge for engineering education to keep pace with the present, and in fact to lead for the future. Every division of the College is committed to improving its undergraduate programs and to advancing graduate education and research, in order to provide Cornell engineers with the foundation essential for active and rewarding professional careers.

Sophomore engineers in an engineering science lecture in Kimball Hall.

THE DEGREE PROGRAMS

UNDERGRADUATE PROGRAMS

The undergraduate degree of the College of Engineering is the Bachelor of Science, awarded upon the completion of *four* years of study. The student attains this degree by spending his first two years in the Division of Basic Studies preparing for his entry into one of the seven *Field Programs* or the *College Program,* where he will spend two years completing the requirements for his undergraduate degree. He then will go on to graduate study or seek employment.

Students intending to engage in the practice of professional engineering will be encouraged to continue their studies for one additional year beyond the Bachelor's degree, and will receive a professional Master's degree. This is an integrated undergraduate-graduate program which accounts for the somewhat shorter time required to earn both degrees.

DIVISION OF BASIC STUDIES

All engineering freshmen undertake a common program of studies, except for those obtaining advanced placement. Mathematics, physics, chemistry, and a liberal arts *elective* are included in the freshman year. In addition, one introductory engineering course taught by members of the engineering faculty is offered each term. One of these introduces fundamentals of engineering graphics and the role that the design function plays in modern engineering. The other course stresses the function and nature of modern engineering, and the interrelationships of several professional fields. Freshmen learn CUPL, the Cornell computing language, while enrolled in this latter course, and make subsequent use of it in their mathematics, science, and engineering courses.

Both of these introductory courses encourage close student-faculty association. Advisers drawn from the College's faculty provide another opportunity for students to become more acquainted with the many opportunities open to them in the Cornell programs.

During the sophomore year, each student furthers his work in mathematics and physics, and elects a liberal studies course in each term. To round out the sophomore year, two engineering science courses are chosen by the student each term. They serve as the link between mathematics and sciences with the professional field studies in the upperclass engineering program. (Details of courses and the Basic Studies program are described in the *Announcement of the College of Engineering*, which may be obtained from the office listed on the last page of this Announcement.)

UPPERCLASS PROGRAMS

After completing the sophomore year, a Cornell engineering student may enroll in one of the

following *Field Programs*: agricultural engineering, chemical engineering, civil engineering, electrical engineering, engineering physics, industrial engineering and operations research, materials science and engineering, and mechanical engineering.

Each *Field Program* is described briefly in the section "Areas of Instruction," pages 17 to 33.

A special curricular structure, the *College Program*, has been arranged to accommodate many engineering patterns not represented by the list above. (See page 23 for a description of this program.)

A Bachelor of Science degree is awarded at the end of the fourth year of study for any of the *Field Programs* or the *College Program*. It may be the terminal point in the formal education of some students, but it is expected that most will continue formal studies beyond this stage.

PROFESSIONAL MASTER'S PROGRAMS

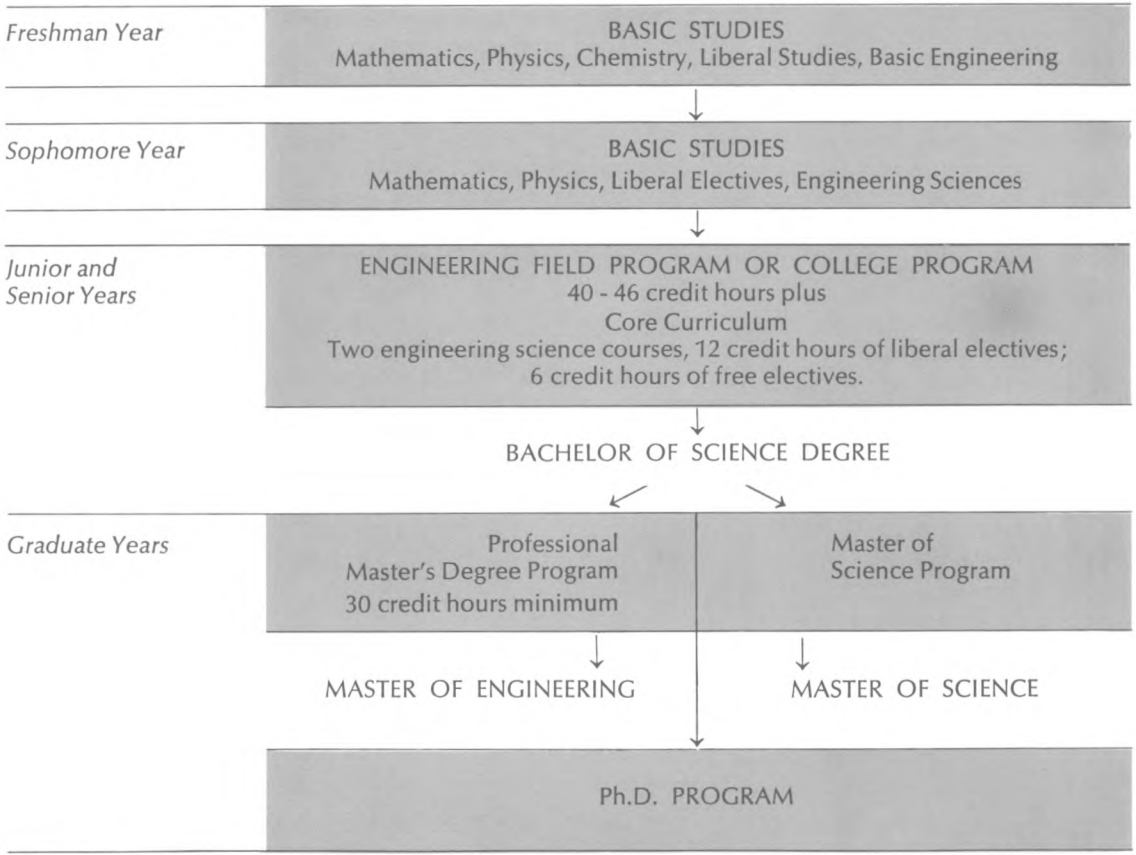
At the completion of a four-year *Field Program*, a graduate may be admitted to the College's professional Master's degree program, earning the degree in one additional year. This fifth year of study is integrated with the last two years of the Cornell Bachelor of Science degree programs and forms an intensive three-year professional studies program in an engineering field.

Opposite: Freshman engineers examining close-up detail of a drawing used in the study of design of engineering systems.

Professional degrees at the Master's level are offered in aerospace engineering, agricultural engineering, chemical engineering, civil engineering, electrical engineering, engineering physics, industrial engineering and operations research, materials science and engineering, mechanical engineering, and nuclear engineering.

These degrees are intended primarily for persons who wish to enhance their ability in the practice of engineering, and not for those who expect to enter engineering teaching or research. The student with a baccalaureate degree in the area of engineering or science deemed appropriate to his proposed field of study may become a candidate for a professional degree.

The professional degrees require a minimum of thirty credit hours of graduate-level work in the principles and practices of the specific field. They do not require the presentation of a thesis based upon research studies; however, they require from three to twelve credit hours in individual work in some aspect of engineering design, including submission of a formal report. Each program also requires completion of a curriculum of related technical courses, differing in content among the several professional degree programs. Each curriculum includes some prescribed and some elective courses, with considerable flexibility to permit adaptation to the special needs of the individual student. (Details of the professional Master's degree curricula and course descriptions may be

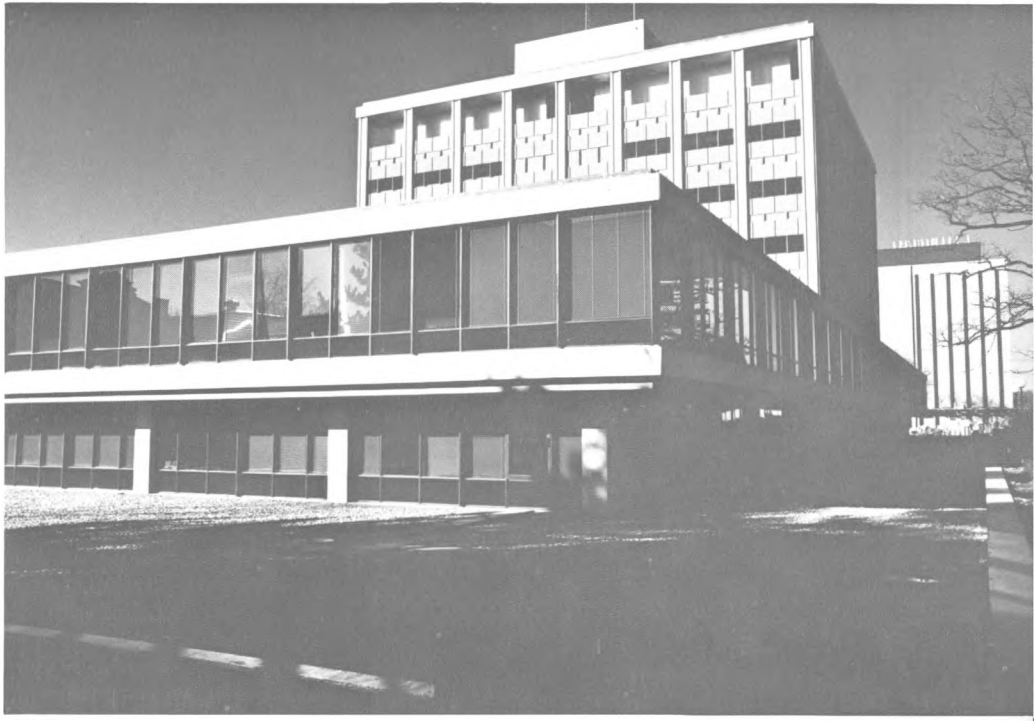

Freshman Year
BASIC STUDIES
Mathematics, Physics, Chemistry, Liberal Studies, Basic Engineering
Sophomore Year
BASIC STUDIES
Mathematics, Physics, Liberal Electives, Engineering Sciences
Junior and Senior Years
ENGINEERING FIELD PROGRAM OR COLLEGE PROGRAM
40 - 46 credit hours plus
Core Curriculum
Two engineering science courses, 12 credit hours of liberal electives;
6 credit hours of free electives.
BACHELOR OF SCIENCE DEGREE
Graduate Years
Professional Master's Degree Program
30 credit hours minimum
Master of Science Program
MASTER OF ENGINEERING
MASTER OF SCIENCE
Ph.D. PROGRAM

found in the *Announcement of the College of Engineering*, which may be obtained from the office listed on the last page of this Announcement.)

MASTER OF SCIENCE AND DOCTOR OF PHILOSOPHY DEGREE PROGRAMS

The Master of Science or Doctor of Philosophy degree programs are oriented to students seeking academic or research careers. These degrees are administered by the Graduate School of the University, where the faculty is organized into "Fields of Instruction". Most of these Fields coincide with the respective engineering Schools or Departments. However, in some instances, the faculty is drawn from more than one division at Cornell. A prospective candidate is invited to write the Graduate Field Representative of the Field in question for detailed information on major and minor area offerings. Master of Science and Doctor of Philosophy Degrees are offered in the following programs: aerospace engineering, agricultural engineering, applied mathematics, applied physics, astronomy and space sciences, chemical engineering, civil engineering, computer science, electrical engineering, industrial engineering and operations research, materials science and engineering, mechanical engineering, nuclear science and engineering, and theoretical and applied mechanics.

Clark Hall is the center for the study of the physical sciences. In the background (right) is the new Chemistry Research Building.



Hollister Hall contains classrooms and teaching and research laboratories for the School of Civil Engineering.

INDUSTRIAL COOPERATIVE PROGRAM

student who intends to pursue a program in electrical engineering, industrial engineering and operations research, mechanical engineering, or engineering physics, may apply for admission to the Industrial Cooperative Program.

If accepted in that program he will have an opportunity to gain practical experience in his chosen field, which can be of value to him in planning his program and carrying out his studies. In addition, he not only earns a substantial salary during his periods of employment but also gains about a year in the amount of responsibility he can undertake upon graduation.

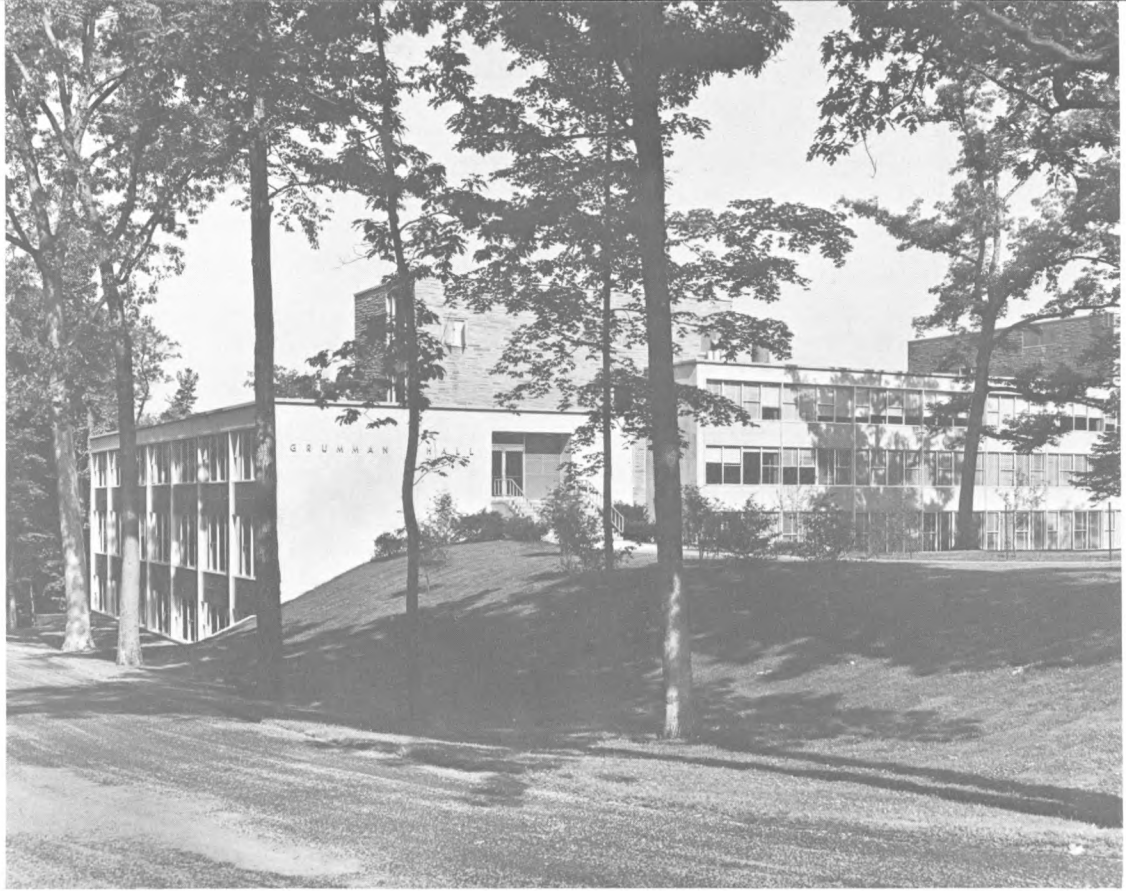
By utilizing the summers following his second, third, and fourth years, the student is able to complete the academic requirements for his Bachelor's degree, pursue his work program totaling nearly one year in industry, and still graduate with his class on time. He is on campus with his classmates except during the fifth term.

The schedule for the Industrial Cooperative Program, beginning after the fourth term, is as follows: summer, fifth-term courses; fall, industry; spring, sixth-term courses; summer, industry; fall, seventh-term courses; spring, eighth-term courses (award of B.S. degree); summer, industry. Students who seek a Master's degree are able to begin graduate study in the fall following receipt of the Bachelor's degree, just as in the regular program.

to advance his individual interests and aptitudes within the regular activity of the company with which he is affiliated. Because the plan visualizes progression of the student in industry from less demanding assignments through to development, research, and other more advanced responsibilities, it is not feasible for any one student to work in more than one industrial organization. He is therefore admitted to the Program by arrangement with one company and is in their employ throughout the program. Neither the student nor the company, however, is obligated in any sense for employment beyond the completion of the Industrial Cooperative Program.

Among the industries presently participating in the Program are: American Electric Power Service Corporation; Anaconda Wire and Cable Company; Campbell Soup Company; Cornell Aeronautical Laboratory; the Emerson Electric Company; the Farrel Corporation; General Electric Company; General Radio Company; Gleason Works; Graflex, Incorporated; Hewlett-Packard, Sanborn Division; Humble Oil and Refining Company; International Business Machines Corporation; Pall Corporation; Raytheon Company; and Xerox Corporation.

Further information is available from the Industrial Cooperative Program Office, 109 Phillips Hall.



Grumman Hall houses Cornell's Graduate School of Aerospace Engineering.

AREAS OF INSTRUCTION

In the Graduate School of Aerospace Engineering, emphasis is placed on the aerospace sciences rather than current aerospace design. Much of the research carried out in this field is concerned with fundamental problems in the dynamics of fluids, including plasmas, and chemical reactions at high temperatures. Whenever possible, these investigations combine the techniques of theory and laboratory experimentation, making use of the experimental facilities of the School, which are housed in Grumman Hall.

Although the School's main concern is its graduate program, its faculty is available for consultation with undergraduate engineers regarding appropriate engineering courses in the upperclass years to prepare them for a graduate program in aerospace engineering. If such students desire a graduate professional degree in aerospace engineering (Master of Engineering [Aerospace]), they may continue their studies and obtain it in one year of graduate study.

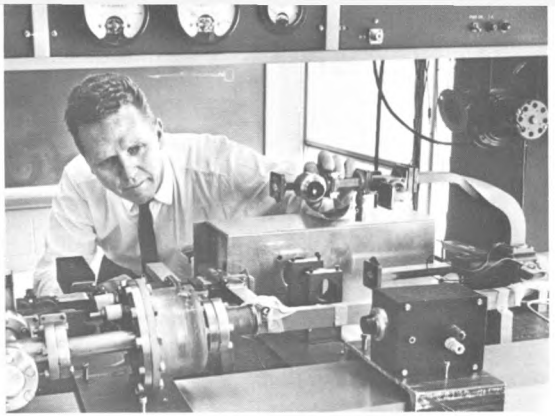
The Graduate School of Aerospace Engineering places students in a research environment and exposes them to teaching by men engaged in research. It does not try to do several other jobs simultaneously but only to carry out this particular responsibility well. Research students get almost unlimited personal attention from their professors. Active research areas in the Master of Science, which are also offered by the School, include: dynamics of gases at extreme temperatures, magnetohydrodynamics, hypersonics, advanced aerodynamics, and aspects of plasma physics. The School also maintains active interest and research in subjects basic to modern space vehicles and propulsions systems.

AGRICULTURAL ENGINEERING

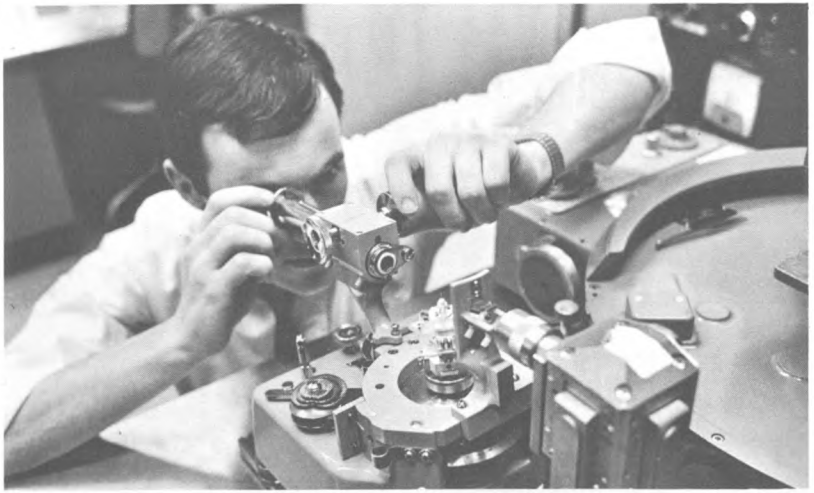
Cornell's program in agricultural engineering, housed in Riley-Robb Hall, is a joint effort of the College of Agriculture and the College of Engineering. The course of study in agricultural engineering prepares the student to apply engineering principles to problems of agriculture. Preparation for such work involves not only the basic knowledge of engineering principles, but also includes courses in agricultural science and the related engineering problems of food and fiber production met in the many industries serving agriculture.

The Department's curriculum includes five basic fields of learning: basic sciences, engineering science, engineering application, agriculture, and general studies. Students register in the College of Agriculture during the first three years, and in the fourth year in the College of Engineering, which grants the Bachelor's degree. Other degrees offered are the professional degree, Master

Right: Adjusting the ultra-sensitive calibration of a bench laser system.



Below: Student aligning a specimen in an X-ray camera to determine its crystal orientation.

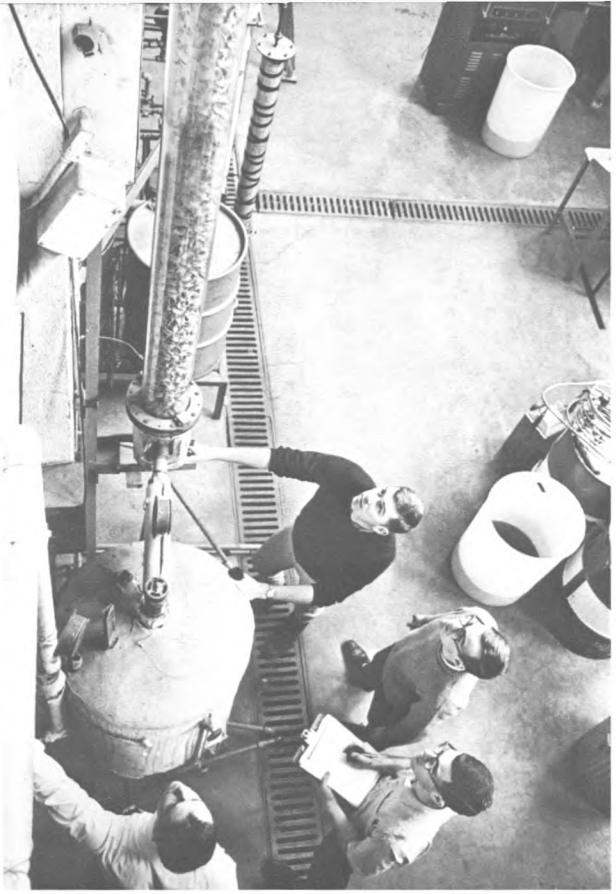


of Engineering (Agricultural), and the research degrees, Master of Science and Doctor of Philosophy.

The traditional areas of agricultural engineering are agricultural structures, crop processing, electrification, power and machinery, and soil and water engineering. Research interests in these fields include the study of atomic energy, solar batteries, and fuel cells as sources of power for the farm; the use of radioactive substances to trace the flow of nutrients in plants, to determine the wear of engine parts, and to measure the amount of moisture in the soil; and the study of environmental control mechanisms and systems as related to plants and animal production.

Chemical engineering involves the application of the principles of the physical sciences, of mathematics, and of engineering judgment to fields in which matter is treated to effect a change in state, energy content, or chemical composition. The School offers the Bachelor's degree, the professional degree — Master of Engineering (Chemical), and the Master of Science and Doctor of Philosophy degrees.

Through courses in the design and operation of processing plants, and in associated problems of economic evaluation and new product development, students learn about the varied dimensions of chemical engineering, including petroleum refining, polymeric materials, nuclear engineering, properties of materials, and food processing. All Cornell programs in chemical engineering, both undergraduate and graduate, are given in Olin Hall of Chemical Engineering, which provides lecture and recitation rooms as well as laboratories for instruction and research. The main laboratory extends through three floors and contains pilot-plant and semiplant equipment for undergraduate projects and research, as well as space for setting up research apparatus for graduate students. In addition, a large portion of the building is devoted to small unit laboratories suitable for chemical and bench-scale projects and research.



Chemical engineers at work in the unit operations laboratory studying the dynamic behavior of a packed column.

Discussing problems in structures, one of many specialized activities in Civil Engineering.

Fields of research specialization in the graduate study programs are biochemical engineering, nuclear engineering, process control, polymeric materials, commercial development and economic evaluation in the process industries, and chemical engineering fundamentals. Some specific research interests within these areas are crystallography, microbial conversion of hydrocarbons, gel permeation chromatography, kinetics of polymerization, saline water conversion, and chemical economics.

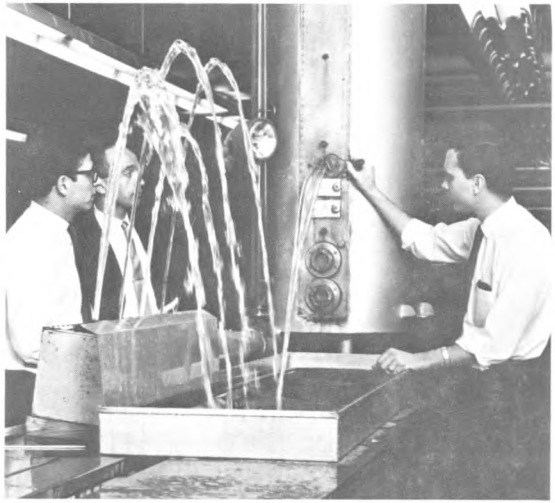
CIVIL ENGINEERING

The scope of civil engineering varies from research and development to broad planning, technical design, construction, operation, maintenance, applications and sales, analysis and testing, and administration and management. The civil engineer must have a sound basis in mathematics, science, and engineering technology. In addition, he should have a good general education to communicate effectively with the many professionals and nonprofessionals with whom he must work.

The School offers the Bachelor's degree; the professional degree, Master of Engineering (Civil); and the Master of Science and Doctor of Philosophy degrees.

After a student has completed the two-year Basic Studies program he takes courses in each of the major subfields of civil engineering — geotechnical engineering, structural engineering, environmental systems engineering, and water resources engineering. He may then concentrate on one subfield or take further work in all areas.

Instruction is vitalized by the School's continuous research programs. Some recent research projects include hyperbolic paraboloid shell roofs, fundamental concepts of the cracking phenomenon in reinforced concrete, the resistance of soils to shearing, and mathematical decision models for operating water resource systems. Hollister



Civil engineers experimenting with the dynamic behavior of jet streams as part of the study of hydraulics.

Hall, Thurston Hall, and the Hydraulics Laboratory at Triphammer Falls house facilities for both instruction and research. These facilities include several laboratories for testing models and full-scale structural assemblies; a concrete laboratory; two hydraulic laboratories; a highway materials and traffic engineering laboratory; sanitary engineering and microbiology laboratories; a soils engineering laboratory; laboratories for engineering analysis and interpretation of aerial photographs; and facilities for preparing maps and processing engineering data by photogrammetric methods.

COLLEGE PROGRAM

The *College Program* has been established to accommodate undergraduate students whose engineering educational objectives require more curricular flexibility than is provided by any of the various *Field Programs*. In the *College Program*, a student may combine sequences of courses from two or more engineering Fields or an engineering course sequence with one in a nonengineering discipline. For example, some of the combinations now under way are: civil engineering and geology, civil engineering and regional planning, computer science and industrial engineering, electrical engineering and biological sciences, electrical engineering and computer science, and mechanical engineering and industrial engineering.

Many more arrangements are possible since Cornell offers an unusually wide range of courses in all its various undergraduate colleges and schools, but the combinations must have an educational objective with an engineering basis.

Admission to the program is made after approval of a student's proposed program of studies, which must include the core curriculum requirements in effect for all engineering students. Applications are submitted to the College Program Committee during the first term of the sophomore year, and the program begins in the junior year.

One of the features of the *College Program* is that it gives students and faculty alike the opportunity to pioneer in new areas of engineering and applied science. Many of these new areas cannot be successfully developed within a Field since, in most instances, they represent the interests of several Fields.

At the end of four years of study, a Bachelor of Science degree is awarded, as in a *Field Program*. For many who complete the *College Program*, work toward the Master of Science degree (or in some cases, the doctorate, directly) may be pursued. Opportunity to earn a professional Master's degree is dependent upon the student's choice of a major within the *College Program* and the courses taken in that major.

Opposite: Relaxing after a lecture in Phillips Hall of Electrical Engineering.

Cornell's engineering programs rely heavily on the Computing Center's facilities. After learning CUPL, Cornell's computer language, the students may use these facilities in their course work.

Computer science, the science of information, is concerned with the nature and properties of information, its structures and classification, its storage and retrieval, and the various types of processing to which it can be subjected. It is also concerned with the physical machines that perform these operations, with the elemental units of which they are composed, and with the organization of these units into efficient information processing systems.

The Department of Computer Science is affiliated with both the College of Arts and Sciences and the College of Engineering. The Department offers the degrees of Master of Science and Doctor of Philosophy. The graduate program in computer science is built upon a foundation of experience in digital computer programming and a background in mathematics, engineering, or other related fields. Courses in computer science may also be elected by undergraduate engineering students. Areas of instruction include programming systems and theory, information organization and retrieval, numerical analysis, automata theory, and theory of effective computability.

The student and staff offices are located in Upson Hall, and the principal laboratory facility is the Office of Computer Services in Langmuir Laboratory. Some of the research projects under way are concerned with the theory of automata and

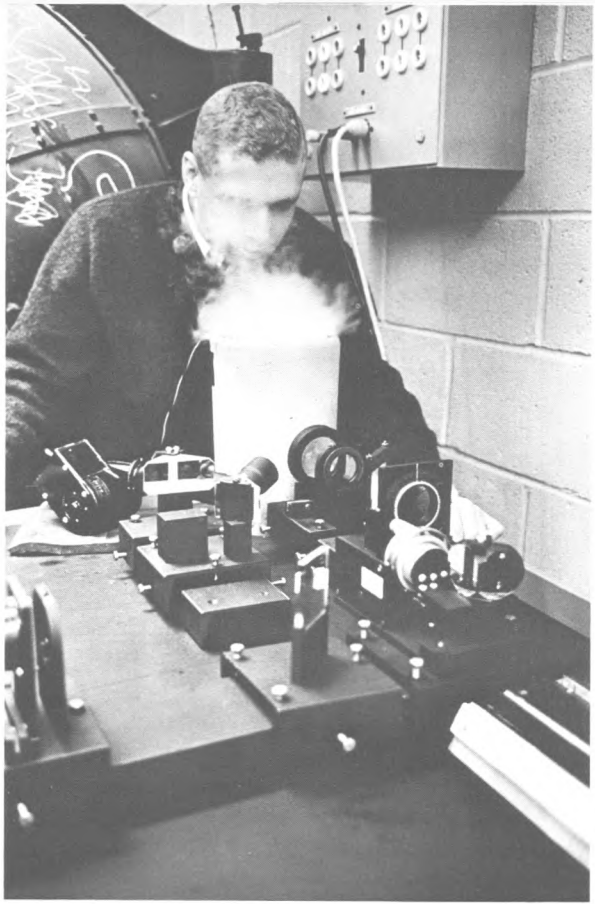
computability, numerical analysis, language development, and fully automatic information retrieval systems.

ELECTRICAL ENGINEERING

At Cornell emphasis is placed on properly combining the essential ingredients of modern electrical engineering — electrical science and creative design. The undergraduate program in electrical engineering is sufficiently flexible so that a student can tailor much of his own program. This is done by choosing electives which build upon a core of required courses in physics, engineering, and mathematics.

A student may choose courses dealing with communication systems; computers and modern control theory; electromagnetic theory; energy conversion and magnetohydrodynamics; information, signal, and detection theory; instrumentation; microwave and solid state electronics; network and system theory; plasmas; power systems; quantum electronics; and radio physics. The student receives a Bachelor's degree after completing four years of study. The first professional electrical engineering degree, Master of Engineering (Electrical), is awarded after the fifth year of study at Cornell.

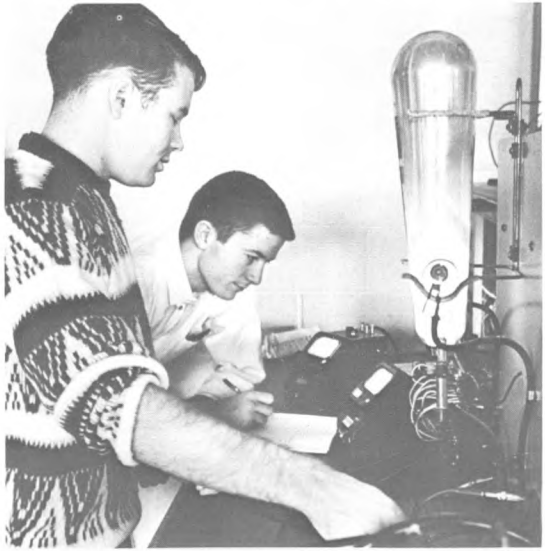
The facilities of the School of Electrical Engineering, housed in Phillips Hall, are extensive



A student setting up a gaseous laser research experiment in Phillips Hall.

Opposite: The nuclear magnetic resonance laboratory where students study structural defects in materials.

Below: Investigating the behavior of an ionized mercury vapor tube.



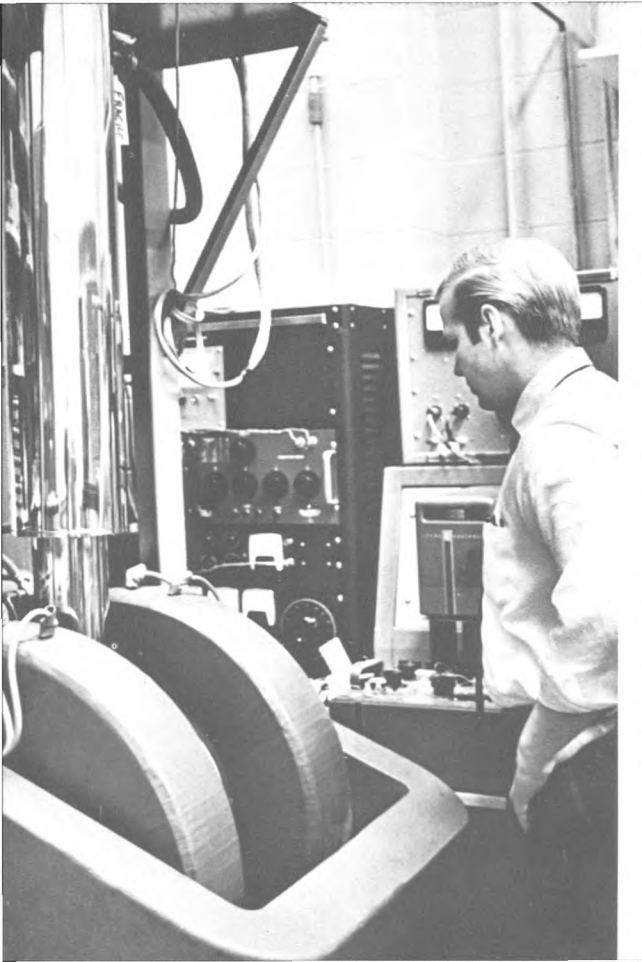
graduates. There is a senior project laboratory in which students can construct and test electronic apparatus of their own design, in addition to many specialized laboratories.

Graduate study in electrical engineering leading to the M.S., the M.Eng., or the Ph.D. degree is divided into two areas: systems and electrophysics. Systems courses include work in the analysis and synthesis of linear networks (passive, active, distributed); the analysis of time-variable and nonlinear systems; signal processing; control system analysis; optimization, and adaptation; random processes in systems; and information theory. The courses in electrophysics include work in radiophysics, microwave electronics, plasma physics, and quantum electronics.

Faculty research interests in the School of Electrical Engineering include biomedical electronics, communication systems, microwave and solid state electronics, radiophysics, and plasmas and discharge phenomena.

ENGINEERING PHYSICS

Cornell's curriculum in engineering physics provides the type of education and training which bridges the gap between the basic sciences and traditional engineering practice. The program puts major emphasis on mathematics and physics.



A faculty made up of members from several science departments of the College of Arts and Sciences, as well as from several of the engineering divisions, manifests the Department's emphasis on new directions which cut across traditional lines. The student pursues courses in physics and applied mathematics, as well as in engineering sciences and a systematic development of electrical and electronic systems. He may take electives in many varied areas, such as gasdynamics, aerodynamics, plasmas, radio astronomy, astrophysics, solid state physics, systems development, and nuclear science and engineering.

Undergraduate study in engineering physics leading to a Bachelor of Science degree provides a foundation for graduate study in engineering physics and in other areas including applied physics, nuclear science and engineering, and aerospace engineering at Cornell.

The facilities of the Department of Engineering Physics are housed in Rockefeller and Clark Halls, and the Nuclear Reactor Laboratory. The Department is equipped for project and research studies in the areas of electron microscopy and diffraction, solid state and surface physics, low-energy nuclear physics, nuclear chemistry, and nuclear reactor physics and technology.

In addition to the Master of Engineering (Engineering Physics) degree program, the faculty offers M.S. and Ph.D. programs in applied physics. Recent research interests of the faculty in-

clude X-ray diffraction studies, optical and electrical properties of ionic crystals, internal friction and dielectrics, active microwave effects in bulk semiconductors, and surface physics.

INDUSTRIAL ENGINEERING AND OPERATIONS RESEARCH

Industrial engineering involves the analysis, design, and operation of integrated systems of men, materials, and equipment. The curriculum has a strong foundation in mathematics and statistical sciences, and sound training in computer sciences and technology is essential. Courses in this program include engineering analysis and design, the science of operations, and decision processes.

Following the first two years in the Division of Basic Studies, the curriculum develops background in probability and statistics, computing, and cost analysis in the third year; and analysis, design, model building, and experimental methods in the fourth year. The fifth year of study, leading to the degree of Master of Engineering (Industrial) includes a two-term project and applied analytical courses.

Graduate study in the Department of Industrial Engineering and Operations Research is offered in five major areas: operations research, system analysis and design, applied probability and statistics, industrial engineering, and information processing. Three degree programs are offered: Master of Engineering (Industrial), Master of Science, and Doctor of Philosophy.

Some recent research activities of the faculty include: ranking and selection procedures, computer simulation of manufacturing systems, information processing, materials handling, statistical decision theory, queuing and inventory theories, network flow, and scheduling.

Upson Hall houses both undergraduate and graduate facilities for the Department of Industrial Engineering and Operations Research, including classrooms, seminar rooms, a methods laboratory, and computing rooms. Also, the Cornell Computing Center is a basic laboratory for the Department.

MATERIALS SCIENCE AND ENGINEERING

Cornell's materials science and engineering curriculum places emphasis on physics, chemistry, mathematics, and engineering sciences. The degrees of Bachelor of Science and Master of Engineering (Materials) are offered. Basic work on materials is continued in courses such as crystallography and other structural aspects of materials, mechanical behavior, phase transformations and their kinetics, and electrical and magnetic properties of materials. Upperclass courses in-

Left: The electron microscope has greatly aided man to peer more closely at the infinitesimally small.

Below: In Bard Hall is a major part of the teaching and research facilities for Materials Science and Engineering.

structure, ceramics, alloy steels, high-temperature materials, nuclear materials, foundry engineering, polymeric materials, and advanced microscopy.

The Graduate Field of Materials Science and Engineering offers opportunities for study toward M.S. and Ph.D. degrees in fields ranging

Preparing a materials sample in the Edward Bausch Laboratory of Metallography, part of Bard Hall's facilities.

Opposite: Varying the condition of the fluid medium in the thermal engineering laboratory.

problems associated with materials applications to a multitude of engineering systems. Some current research interests of the faculty are radiation damage, crack growth and fracture, solid solution hardening, dislocation mechanics, imperfections in crystals, and surface physics.

Materials science and engineering undergraduate and graduate instruction and research are centered in Bard Hall, with additional space in Thurston, Kimball, and Clark Halls. There are facilities for studying structure of solids by physical measurements, microscopy, metallography, and X-ray diffraction, and for processing materials by casting, welding, heat treatment, compacting, sintering and deformation. The Department also participates in the Materials Science Center, which was established by funds from the Advanced Research Projects Agency of the United States Department of Defense.

MECHANICAL ENGINEERING

The Sibley School of Mechanical Engineering, in Upson Hall, is involved in studying two major streams of technology: the conversion and utilization of energy, and the design and production of goods, machines, equipment, and systems. The program in mechanical engineering, leading to a Bachelor of Science degree, is designed to provide

ing sciences basic to the field, and with an introduction to the professional and technical areas concerning the field. In addition, the professional degree, Master of Engineering (Mechanical), is offered, the core of which is a comprehensive design project in collaboration with an industrial firm.

Students in mechanical engineering choose from courses in thermal engineering, machine design, and materials processing; in addition, they take courses in other related departments of the College.

Areas of graduate study leading to either an M.S. degree or a Ph.D. degree are divided into two fields: thermal engineering and machine design. Thermal engineering includes work in heat transfer, fluid mechanics, plasma studies, and energy conversion, while lubrication, mechanical systems dynamics, stress analysis, and machine tools are areas covered in machine design. Some recent research projects in mechanical engineering are the study of dynamic behavior of "dry spots" in a heat exchanger passage with two-phase flow, investigations of rotational or vortex flow which may find application to the problem of fuel containment in gascore nuclear reactors, analytical solution for the behavior of lubrication film under many dynamic loadings, and the study of dynamic and propulsion problems in automotive vehicles.

The Nuclear Reactor Laboratory facilities include the TRIGA reactor (shown), a gamma irradiation cell, and a "zero power reactor."

Nuclear science and engineering is concerned with the understanding, development, and practical application of the scientific knowledge of nuclear reactions and radiations. The aims of the programs at Cornell are to provide the student with a thorough understanding of the laws and principles upon which nuclear systems are based, to develop research abilities, and to develop the skills of applying basic principles to engineering problems. To implement these aims, Cornell offers three degrees: the research degrees, Master of Science and Doctor of Philosophy; and a professional degree, Master of Engineering (Nuclear). Courses in nuclear science and engineering may also be elected by undergraduate engineering students.

The program of studies in nuclear engineering is not presented in a rigid pattern; rather, the student chooses his courses according to his interests and background. A student must be able to assimilate new developments in the basic sciences, recognize their significance for engineering problems, and initiate the technical realization of the solutions he proposes.

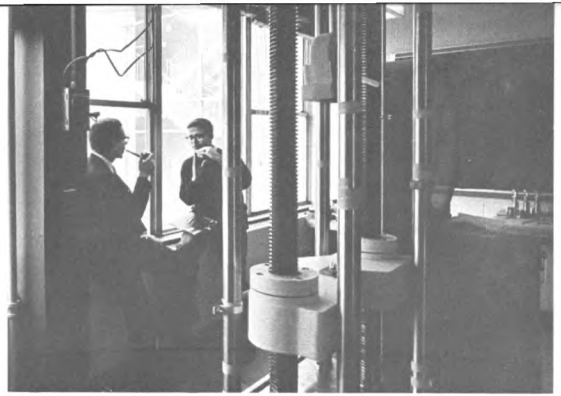
Radiation chemistry, radiation detection, low-energy nuclear physics, neutron scattering, radioactive waste disposal, and reactor physics are some of the faculty's research interests. Research is done for the most part in the Nuclear Reactor

Laboratory, which has, among its facilities, a TRIGA reactor, a "zero power" reactor, a gamma radiation cell, a Cockroft-Walton accelerator, subcritical assemblies for reactor physics investigations, and a radiochemistry laboratory.

THEORETICAL AND APPLIED MECHANICS

The Department of Theoretical and Applied Mechanics is responsible for undergraduate engineering instruction in the mechanics of rigid and deformable solids. In addition, it offers to undergraduate engineers a major or minor in mechanics or engineering mathematics through the *College Program* option (see page 23), leading to a Bachelor's degree. It also offers, with the University's Department of Mathematics, the introductory applied mathematics course for engineers.

Graduate work in mechanics leads to a Master of Science or Doctor of Philosophy degree. It emphasizes thorough understanding of the basic principles underlying modern theories and methods of analysis that are used to describe macroscopic behavior of solids and fluids, with application to the newest developments in engineering and applied science. Study in this field is organized in three categories: solid mechanics, fluid mechanics, and mechanics of materials. Some recent research topics include the investigation of local stress effects in composite materials, diffraction of elastic waves with application to ground shock and dynamic stress concentration problems, a study of magnetoelastic stability of plates, the use of nonclassical variational calculus and mathematical programming techniques to analyze plastic limit analysis problems, an analytical investigation of hydromagnetic flow past a blunt body, and a study of the dynamic behavior of thin-walled structures subjected to initial stress environments.



The offices and facilities of the Department of Theoretical and Applied Mechanics are located in Thurston Hall. In addition to standard testing equipment, Thurston Hall houses a complete graduate research vibrations laboratory and a photoelasticity laboratory. Students also use the facilities available at the Cornell Computing Center.

New Cornellians leaving Bailey Hall after the Freshman Convocation.

CAMPUS LIFE

Perhaps the best way to describe the extracurricular opportunities on the campus is to say that there is literally something to interest everyone among the great variety of organizations, clubs, publications, athletic programs, and hobbies.

RELIGIOUS ACTIVITIES

Although Cornell has been a nonsectarian institution from its founding, it has a center for the coordination and sponsorship of religious activities. Anabel Taylor Hall, the headquarters for Cornell United Religious Work, includes a staff of twelve University chaplains representing the major religious traditions, and a director and his associates. CURW's thirteen religious groups, as well as students who have no specific religious affiliation, meet for inquiry, study, worship, counsel, and fellowship. Anabel Taylor Hall has an interfaith chapel and is the center of the One World Club, a large group of American and international students. In addition, each Sunday distinguished visiting clergymen from throughout the world conduct interdenominational services in Sage Chapel. Ithaca churches welcome Cornellians to their congregations and offer programs of particular interest to them.

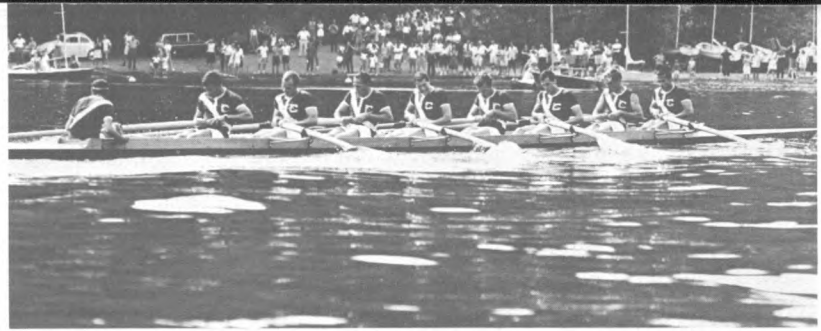
ATHLETICS

With the largest intercollegiate athletic program in the country, including twenty-two sports, anyone can go out for intercollegiate teams, and he doesn't have to be an expert. In fact, in some sports, many students become varsity members after having played for the first time at Cornell.

As a member of the Ivy League, Cornell participates in its organized associations in football, soccer, basketball, wrestling, fencing, lacrosse, and squash, and is a member of the Eastern Intercollegiate associations in golf, swimming, 150-pound football, rowing, baseball, and the Heptagonal Games in track and cross country. Also on the intercollegiate program are polo, rifle, and sailing. Archery, cricket, rugby, and skiing are conducted on an informal basis.

But this is only a small part of the athletic program. Everybody always seems to be playing something—not only in intramurals, in which leagues are going throughout the year, but in innumerable pickup games and matches. Students can get instruction in individual sports such as swimming, tennis, and squash, or in golf on Cornell's eighteen-hole course. One of Cornell's aims is to give students a chance to learn and take part in sports that can be carried on after college.

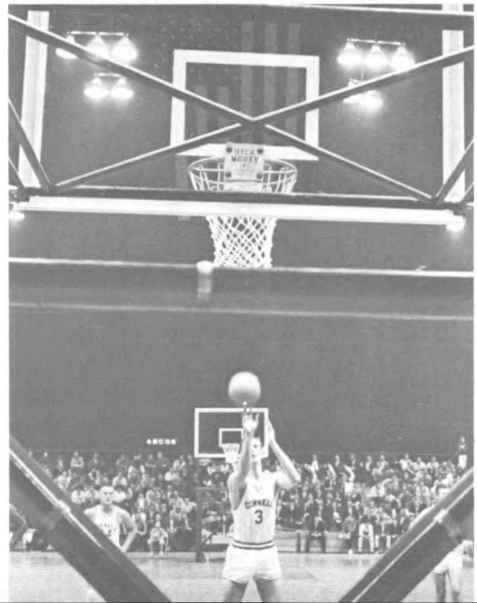
Cornell's forty-eight acres of playing fields are almost all on campus or within walking distance, with tennis courts at various locations. Teagle Hall has two swimming pools, a gymnasium, and rooms for wrestling, fencing, boxing, rowing, and exercises. Varsity and intramural basketball, wrestling, and indoor track, including the Heptag-



Opposite: The Heptagonal Track Meet is held annually at Cornell's Barton Hall, featuring all the Ivy League teams plus Army and Navy.

Above: A Cornell crew sprints on Cayuga Lake.

Right: Basketball is one of many winter sports on the Cornell calendar.



onal Games, take place in Barton Hall, the huge armory, which also has a rifle and pistol range. Lynah Hall is for hockey and skating, and the Grumman Squash Courts have facilities for six teams. The Riding Hall is the scene of polo matches and instruction in horsemanship, and Bacon Cage has indoor baseball and track practice, and instruction in golf. Off campus, Moakley House and Collyer Boat House serve golf and crew. Schoellkopf Field is the home of the Big Red football team.

This uncommonly well conceived and superbly equipped plant is given maximum usage. More than two thousand men come out for the intercollegiate teams each year, and about four thousand, undergraduates and graduates, take part in the seventy-eight intramural leagues.

LECTURES, CONCERTS, AND THE ARTS

The College of Engineering, as part of a large and educationally diverse University, is able to offer its students a broad spectrum of lectures covering all topics of human interest and concern. Among the visiting lecturers heard during 1966-67 were Dr. James L. Goddard, Director of the Food and Drug Administration; Floyd B. McKissick, National Director of the Congress of Racial Equality; the Right Reverend James A. Pike, Bishop of the Episcopal Diocese of California; Samuel Lubell, Graduate School of Journal-


BROWN
COLUMBIA
CORNELL
HARVARD
NAVY
PRINCETON
YALE

Editor-in-Chief of the *Christian Science Monitor;* and the Honorable Dean Rusk, Secretary of State. In addition, many faculty members from other colleges and universities gave programs at Cornell.

The University Faculty Committee on Music sponsors visiting soloists and major orchestras in two Bailey Hall series, string quartets and other groups in the Chamber Music series in Alice Statler Auditorium, and occasional operas, ballets, and special events. In addition, the Department of Music and the Program Committee of Willard Straight Hall join in sponsoring some sixty-five free concerts and lectures by visiting artists or by Cornell faculty and students.

The Andrew Dickson White Museum of Art contains the University's collection of paintings, prints, and sculpture, plus several areas devoted to special traveling exhibits. The S.C. Johnson collection of contemporary American art, *Art: U.S.A.*, drew record crowds this past year at the museum, before it was presented to the permanent collection of the Smithsonian Institution. The student center in Willard Straight Hall sponsors creative art exhibits, often the work of students, operates a music room, and has a collection of phonograph records which may be used by a student in his own residence.

With Cornell's large number of international students, numbering more than a thousand, visits groups are frequent; this provides opportunities for Cornell students to become better acquainted with the cultures of more remote corners of the world.

SOCIETIES, CLUBS, AND STUDENT ORGANIZATIONS

For the many students interested in music, Cornell offers ample opportunity to join one of a number of groups. In the spring term of 1966, the University Glee Club, under the direction of Thomas Sokol, presented over twenty-five concerts in Ceylon, Thailand, Singapore, Malaysia, the Philippines, Hong Kong, Taiwan, Okinawa, Korea, and Japan. In addition they have joined with the Philadelphia Orchestra in concerts in Philadelphia, Ithaca, and the Saratoga Center for Performing Arts. Every Sunday, the Sage Chapel Choir sings at services conducted in Sage Chapel.

The hundred-square Big Red Band, one of the nation's renowned college bands, makes fifty appearances a year, and two Concert Bands give symphonic concerts on campus — indoors during the winter months and outdoors during spring. Other musical clubs put on and sponsor musical comedies, jazz, Gilbert and Sullivan, and folk songs.

The Debate Association, a member of the Ivy League Debate Conference, engages in nearly a

lighted by one with a British university.

Each year the Cornell Dramatic Club presents in the University Theatre six major productions of traditional, modern, and original plays. These, as well as some twenty-five Drummond Studio Workshop productions, offer an opportunity to those who want to try a hand at acting, lighting, stagecraft, costuming, or directing.

A strong voice in the University affairs is the *Cornell Daily Sun*, a full-scale daily newspaper freely operated by the students. The *Sun* carries world, national, and University news. Students also publish a yearbook, the *Cornellian*, and several literary and humor magazines. Of particular interest to the engineer seeking experience on a student publication is the *Cornell Engineer*, one of the finest undergraduate engineering magazines in the country. The *Engineer* not only offers opportunities for editing, business management, and technical writing, but provides acquaintance with action "behind the scenes" in the College.

There are international and political clubs, service clubs, professional and departmental societies, and clubs devoted to almost anyone's hobby. Student announcers and technicians of the Cornell Radio Guild staff and operate the campus station, WVBR. Radio hams of the Cornell Amateur Radio Club have a well-equipped radio shack and workshop, own an amateur radio station, and operate a public address system. Cayuga Lake provides

A Sunday afternoon "Pop Concert" on the Library slope.

Corinthian Yacht Club. The Photo Club has full darkroom facilities. The Outing Club not only takes advantage of Cornell's surroundings for hiking, skating, and skiing, but plans mountain climbing trips to the Adirondacks, the Green Mountains, and even to Canada. Other clubs bring together those interested in skiing, polo, rifle and pistol, chess, cricket, folk dancing, and many other activities.

A large number of these clubs and organizations are centered in Willard Straight Hall. "The Straight" includes several dining rooms and cafeterias, the University Theatre, an arts and crafts workshop, game rooms, and a browsing library. Included in its facilities are guest rooms for visiting parents and friends.

RECREATION

Cornell is situated in one of the major outdoor recreational centers of the East. For the outdoor enthusiasts, three beautiful state parks are only a few minutes' drive from the city: Buttermilk Falls, Robert H. Treman, and Taughannock Falls, which contains a 215-foot waterfall, the highest east of the Rockies. The parks have abundant picnic facilities, glens, cascades, and hiking trails. In Ithaca itself is Stewart Park, a municipally owned park on Cayuga Lake with wide lawns and several picnic areas; also on the grounds are the Fuertes

tuary. Cayuga Lake provides excellent boating conditions, and Cornell's boathouse is located conveniently on an inlet feeding into the lake.

In the spring Beebe Lake offers an opportunity for canoeing or swimming, on campus, and in winter, for outdoor skating. For the increasing number of ski enthusiasts among the student body, Greek Peak, approximately fifteen miles away, offers fine skiing for beginners and experts. Cornell's gorges and streams never cease to be fascinating. For those who prefer just relaxing, the Library Slope has grass, shade, a magnificent view of Cayuga Lake, and occasional outdoor band concerts. There are movies downtown and on campus, plays, concerts, a variety of dances and parties, and all kinds of intercollegiate athletic events. Astronomy enthusiasts can visit Fuertes Observatory, and bird lovers, the famous Sapsucker Woods.

On campus and throughout the Finger Lakes Region are recreation areas and resorts. Opposite: Putting on Cornell's eighteen-hole course. At right: sailboats moored on Cayuga Lake.

Heading down "Libe" slope to the men's residence halls.

Nearly all freshmen live in dormitories which are within convenient distance of academic buildings, libraries, and dining facilities. Students from the various colleges live together in the same buildings, one or two to a room. Unless they have other preferences, those who request double rooms are assigned a fellow student in the same college. On the ground floor of each dormitory is a large social lounge with a kitchen, and on each of the other three floors, a separate lounge. In the central dormitory there is a cafeteria open during mealtimes and evenings. Dormitory students can dine in various University cafeterias and dining rooms according to their own choice and schedule. Those who wish may save by prepaying for their meals for an entire semester.

Upperclassmen may reside in dormitories, fraternity houses, cooperative houses, or off-campus rooms or apartments. The University has two residence halls for graduate students, one of which is coeducational. Unfurnished apartments for four hundred married students and their families are provided by Cornell. All students living off campus must reside in University-approved housing; a current listing is posted at the Off-Campus Housing Office in Day Hall. If possible, a student planning to live off campus should visit Ithaca well in advance of taking up residence in order to look over available apartments and houses.

Detailed information on all types of housing for students may be obtained by writing to the Department of Housing and Dining Services, Day Hall.

HEALTH SERVICES

Complete health services at Cornell's Gannett Medical Clinic and Sage Hospital (a fully accredited hospital) are available to all regularly registered students. Student fees cover treatment and care at the Clinic and Hospital with up to two weeks of hospitalization per term, including medical and emergency surgical care, and laboratory and X-ray examinations indicated for diagnosis and treatment. The medical staff consists of attending physicians from the University staff and consulting physicians and surgeons in the various medical fields from Ithaca and vicinity.

In addition, a student may subscribe to an elective insurance plan to supplement the above services, providing coverage for hospital care in excess of fourteen days and for illness and accidents outside Ithaca during both the academic year and vacations. Further information may be obtained at the Clinic.

PHYSICAL EDUCATION

All freshmen and sophomores are required to take physical education with the exception of veterans, students with advanced standing who

SPECIAL STUDENT SERVICES

have satisfactorily completed four terms of college, and individuals exempted for medical reasons or by reason of age, residence, or outside responsibilities.

The program, which for freshmen changes every six weeks, includes basketball, golf, tennis, volleyball, wrestling, and swimming. Sophomores concentrate on one or two sports which they can continue during their upperclass years and after graduation. In addition to a complete intercollegiate program, the University sponsors and directs a very active intramural program in which a majority of the upperclassmen participate.

OFFICER EDUCATION

Cornell offers instruction in military science through the Reserve Officers' Training Corps programs of the three military departments — the Army, the Navy and the Air Force. A college student may thus fulfill his military commitment as a commissioned officer or become qualified for a career in the service while earning his degree.

To obtain a commission in one of the services, a student must complete a two-year or a four-year course of study in an ROTC program and must meet certain physical standards. A Marine option is available at the beginning of the third year for selected NROTC students. Upon graduation the student receives a commission and, commencing within one year after graduation, serves a required tour of active military service. Deferments may be granted to individuals wishing to undertake graduate study at their own expense after commissioning; length of active duty is not affected.

Participation in any of the ROTC programs is voluntary. Students are encouraged to consult with their school advisers, counselors, and local draft boards. Enrollment should preferably take place in the fall of the freshman year, since openings in the two-year program may be restricted, depending on conditions at any particular time.

Further information is given in the *Announcement of Officer Education*, which may be obtained by writing to Cornell University Announcements, Day Hall.

COUNSELING AND ADVISING

Each undergraduate is assigned a faculty adviser from one of the engineering fields of his interest to help him in his selection of courses. The Office of the Dean of Students maintains a staff of counselors and advisers to assist any student with any nonacademic problems. Students desiring assistance in the diagnosis of academic problems, selection of curriculum, or determination of vocational goals, may also be directed to the Educational-Vocational Guidance Office for intensive testing and counseling.

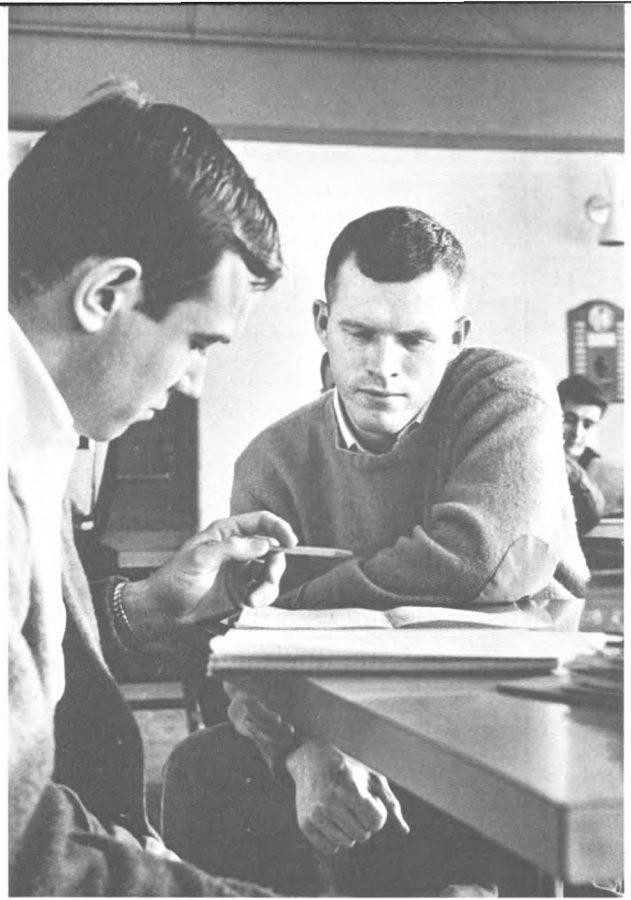
Referrals may be made to the other professionally trained members of the University and Col-

lege staffs who are best qualified to be of specialized assistance for particular problems. The International Student Office in Day Hall provides additional information and guidance for foreign students. The Reading and Study Skills Center offers all students the opportunity to improve reading and study skills essential for academic success.

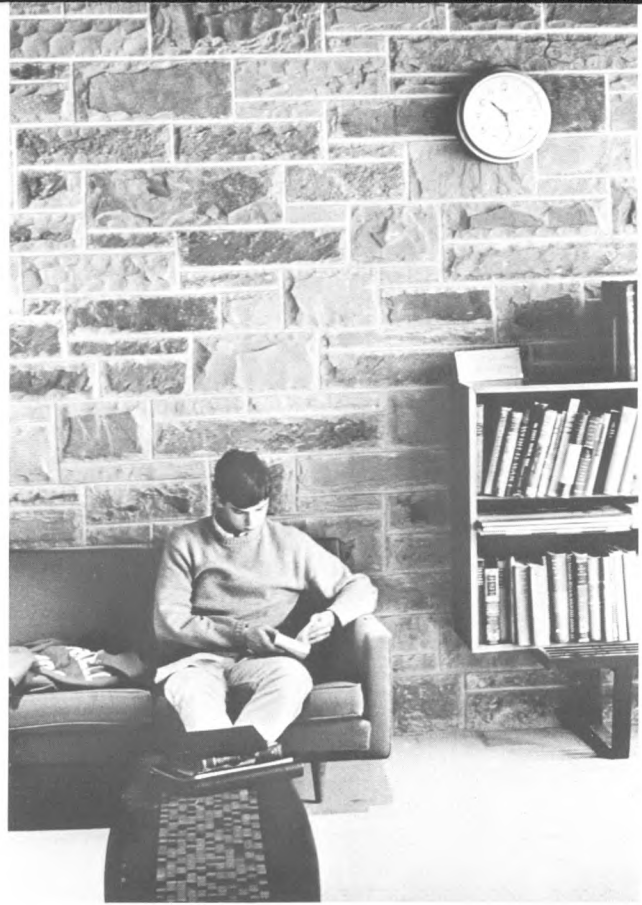
PROFESSIONAL GUIDANCE AND PLACEMENT

Engineering students have excellent opportunities to learn about and participate in the research and current developments in their profession and to discover where their interests may lie. In addition to faculty and advisers, students learn much about their professional area through participation in their student chapters of the various professional societies, such as the American Institute of Chemical Engineers, American Institute of Industrial Engineers, American Society of Civil Engineers, and American Society of Mechanical Engineers.

The Student Personnel Office of the College works with the University Placement Service in the arrangement of interviews with prospective employers, and in the maintenance of student records, at no charge to the student. In 1966 representatives from more than 350 companies visited the campus to interview engineering degree candidates.



Informal conversation between classes in one of the several student lounges located in the engineering buildings.



Reading and study rooms on campus are numerous and comfortable.

Besides helping both students and alumni to obtain professional employment, the Placement Service assists them in furthering their career interests in other ways. It has information on study and travel abroad, social projects, camp and resort jobs, and career-oriented summer jobs. It also has literature on graduate study here and abroad, and it arranges on-campus interviews between seniors and representatives from a number of graduate schools.

EMPLOYMENT OPPORTUNITIES

Engineering students are not encouraged to undertake part-time employment in the freshman year, when they are getting accustomed to courses and college life. The Office of Scholarships and Financial Aid maintains a part-time student employment service. In addition, opportunities for part-time work are often available in connection with departmental research projects or other activities. Applications for such positions should be made directly to the department concerned. Work closely allied to the student's academic interest may have great professional value. A number of part-time jobs are also available in Ithaca businesses. However, any work unrelated to the student's interest may retard his progress toward a degree, and it may be better to take a student loan.

ADMISSIONS INFORMATION

Detailed information about requirements for admission and procedures is given in the Cornell *Announcement of General Information*, which every candidate should read carefully. It can be obtained by writing to the Cornell University Announcements Office. All correspondence concerning admission to the College of Engineering should be addressed to the Office of Admissions, Day Hall, Cornell University, Ithaca, New York 14850, which will forward application blanks on request. Places to write for further information are listed on the last page of this Announcement.

Sixteen units* of college preparatory subjects are required for admission. The following fourteen units must be included:

English	4 units
History	2 units
One foreign language	2 units
Algebra (elementary and intermediate)	2 units
Plane geometry	1 unit
Trigonometry	½ unit
Advanced algebra or solid geometry	½ unit
Chemistry	1 unit
Physics	1 unit

*A unit is one year of study, made up of 120 hours of classroom work; that is, a minimum of 160 class periods if each is forty-five minutes long.

Two years of a foreign language are required; it is hoped that the prospective student will have studied one language for three or four years. As more engineering students go on to graduate school and prepare for research careers, the need to know other languages increases, and those who study for Ph.D. degrees usually must have a working knowledge of two foreign languages, preferably German, Russian, or French. Unless the start on this requirement is made in high school, time must grudgingly be spent learning languages at the height of one's professional training.

Applicants will be admitted to the College of Engineering who in all essential respects have demonstrated a high order of scholastic achievement and who, so far as can be determined, have a well-considered desire to study engineering. In addition, they must possess positive characteristics in regard to work and study, and the maturity which will be necessary to meet the demands of living successfully in a complex and demanding university environment. Good grades or high College Board scores are in themselves no guarantees of success or even of admission. A strong motivation and the determination to achieve are important.

The Scholastic Aptitude Test of the College Entrance Examination Board is required of all freshman applicants. In addition, Achievement Tests in mathematics (Level I or Level II) and in chemistry *or* physics are required of all applicants

not later than January of their last year in secondary school. Generally, it is recommended that the Achievement Test in science be taken in May of the junior year, in that science in which the applicant is enrolled. The admissions committee will, however, consider any Achievement Test in science which is taken in December or January of the senior year for a course completed in the junior year, or earlier, or for a course currently in progress.

ADVANCED PLACEMENT

Through cooperation with the advanced placement program of the College Entrance Examination Board and as a result of departmental tests given during the fall orientation period, normally one-fifth of the class is given advanced placement or actual college credit for one or more courses of the freshman year. This makes possible more individual development toward a broader liberal program or advanced technical study in line with

A student lounge for engineering students.

the student's own inclination. Superior students, who have achieved advanced placement in mathematics and in *either* chemistry *or* physics upon graduation from high school, may find it possible to enroll at the sophomore level if they attend the University summer session preceding September matriculation and take the other science. Students with superior performance in the freshman year are encouraged to enroll in Honors sections at the sophomore level.

TRANSFER STUDENTS

Students desiring to transfer to the College of Engineering from another university or college are invited to communicate with the Director of Engineering Admissions, Carpenter Hall, if they have the equivalent of two or fewer years of applicable college credit.

GRADUATE DEGREE PROGRAMS

GENERAL DEGREES

A graduate student holding a baccalaureate or equivalent degree from a college or university of recognized standing may pursue advanced work leading to a graduate degree in engineering. Such a student may enter as a candidate for the general degrees (M.S. or Ph.D.) or for the professional engineering degrees — Master of Engineering (Aerospace, Agricultural, Chemical, Civil, Electrical, Engineering Physics, Industrial, Mechanical, Materials, or Nuclear).

The M.S. and Ph.D. degrees are administered by the Graduate School, and a prospective graduate student should consult the *Announcement of the Graduate School* for additional information concerning these degrees.

PROFESSIONAL MASTERS' DEGREES

Professional degrees at the Master's level are offered in aerospace, agricultural, chemical, civil, electrical, engineering physics, industrial engineering and operations research, materials science and engineering, mechanical, and nuclear enginering. All except the degree in aerospace engineering are administered by the Engineering Division of the Graduate School. The Master of Engineering (Aerospace) degree is granted on the recommendations of the faculty of the Graduate School of Aerospace Engineering.

These degrees are intended primarily for persons who wish to enhance their ability in the practice of engineering, and not for those who expect to enter engineering teaching or research. The professional degrees require a minimum of thirty credit hours of graduate-level work in the principles and practices of the specific field.

A candidate interested in entering the graduate professional program should write to the director of the division of engineering he plans to enter.

FINANCIAL AID

UNDERGRADUATE AID

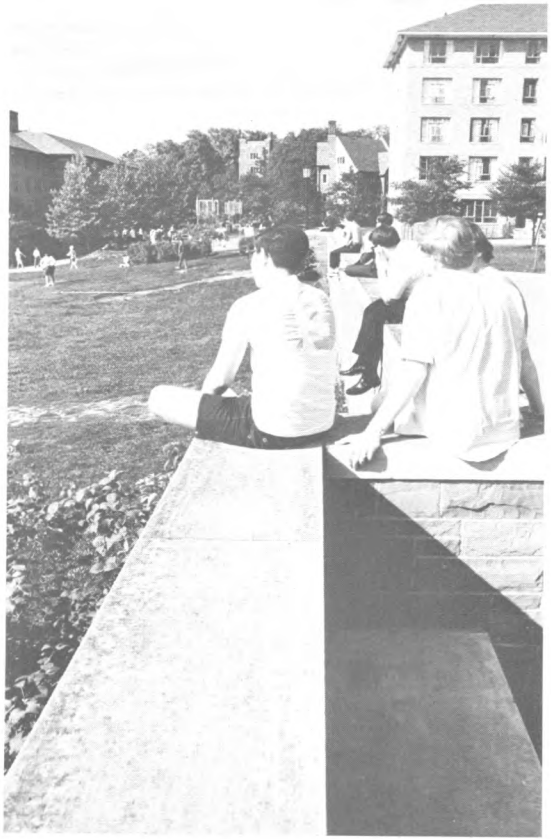
Cornell awards three kinds of financial assistance to undergraduates — scholarships, loans, and employment opportunities. In the majority of cases, the students receiving financial assistance are awarded a combination of scholarship, loan, and/or employment. However, in some cases, students may be eligible for special awards which provide the full amount in scholarship. In the 1965-66 academic year, two-thirds of all undergraduates enrolled in the College of Engineering obtained some form of financial assistance. The total aid, exclusive of part-time employment, amounted to $1,700,000.

Scholarships. This is assistance in the form of gifts which is applied toward college expenses. There are a number of scholarships which carry special stipulations such as living in a particular region or following a special course of study; however, the applicant need *not* apply for a specific award. The University will automatically assign the individual to the appropriate funds. Slightly more than 50 percent of Cornell's undergraduate engineers received a University scholarship, with a median annual value of approximately $1000 per recipient. In addition, 28 percent had New York State Regents' Scholarships with a median value of $500.

Loans. Long-term loans are available to students with financial need and are considered to be an important resource in meeting the cost of education. Loans are used to supplement scholarship awards as well as to provide assistance when there are no scholarship funds available.

Cornell utilizes funds from the University, National Defense, and state loan programs. The Office of Scholarships and Financial Aid assigns an applicant to one of these sources depending upon his eligibility and the amount of money available. Therefore, it is *not* necessary for an applicant to apply for specific funds. During 1965-66, $280,000 in long-term loans was awarded to about 27 percent of the undergraduate engineers.

Because the total amount of financial aid available to freshmen is limited, there are more candidates with financial need who qualify for admission than can be offered aid. Therefore, the candidate's complete record, including academic excellence and potential extracurricular achievement and leadership, and personal qualities, is carefully evaluated in the selection of award winners. The financial aid award selection is a complex and separate process, and the admission decision is in no way affected by the filing of a financial aid application.



GRADUATE AID

Financial aid to graduate students is available in several forms: fellowships and scholarships, research or teaching assistantships, residence hall assistantships, and loans.

Graduate students whose major subjects are in the various fields of engineering and who wish to be candidates for scholarship or fellowship aid should consult the *Announcement of the Graduate School* and make application to the Dean of the Graduate School. Those who are candidates for the professional engineering degrees should apply to the director of the appropriate Field of graduate study. Information relating to application for the other forms of financial aid mentioned above will also be found in the *Announcement of the Graduate School.*

Enjoying a spring afternoon on the grounds of Men's Residence Halls.

FURTHER INFORMATION

All prospective students should obtain the *Announcement of General Information.* (See below.)

Engineering curricula and course descriptions:
Cornell University Announcements
Edmund Ezra Day Hall
Ithaca, New York 14850

Scholarships:
Office of Scholarships and Financial Aid
Edmund Ezra Day Hall
Ithaca, New York 14850

Admission requirements, procedures, and applications:
Office of Admissions
Edmund Ezra Day Hall
Ithaca, New York 14850

General Information and Other Announcements, listed below:
Cornell University Announcements
Edmund Ezra Day Hall
Ithaca, New York 14850

Announcements are available for other academic divisions of Cornell University as follows: State College of Agriculture, College of Architecture, College of Arts and Sciences, School of Education, International Studies, State College of Home Economics, School of Hotel Administration, State School of Industrial and Labor Relations, Officer Education, Summer Session. Graduate study is described in other Announcements as listed on the cover of the *Announcement of General Information.* (When requesting information, the writer should include his zip code.)

Designed by
Lynda A. Thompson, Office of University Publications